Blue Crab Parameter Error – 9-9-2019

The Brylawski and Miller (2003) bioenergetics model for Blue Crab was not included in the suite of models included with Fish Bioenergetics 4. It was not initially clear why. Perhaps, this is because when the model was added to FB4 the model parameters did not match up with the curves in the paper. There appears to be a parameter error in this paper.

To parameterize FWM for LPR, Windward and WPC independently added the parameters to the FB4 input file and ran the model. I was recently checking the FB4 output against the curves in the paper when I realized the apparent error. I then recreated the equations for the FB4 respiration calculations (equation set 2) and received the same answer as FB4, but again, different than the curve shown in the paper (Figure 1). Finally, a corrected parameter set was derived by changing the RQ parameter and the resulting model closely reproduces the data shown in the paper.

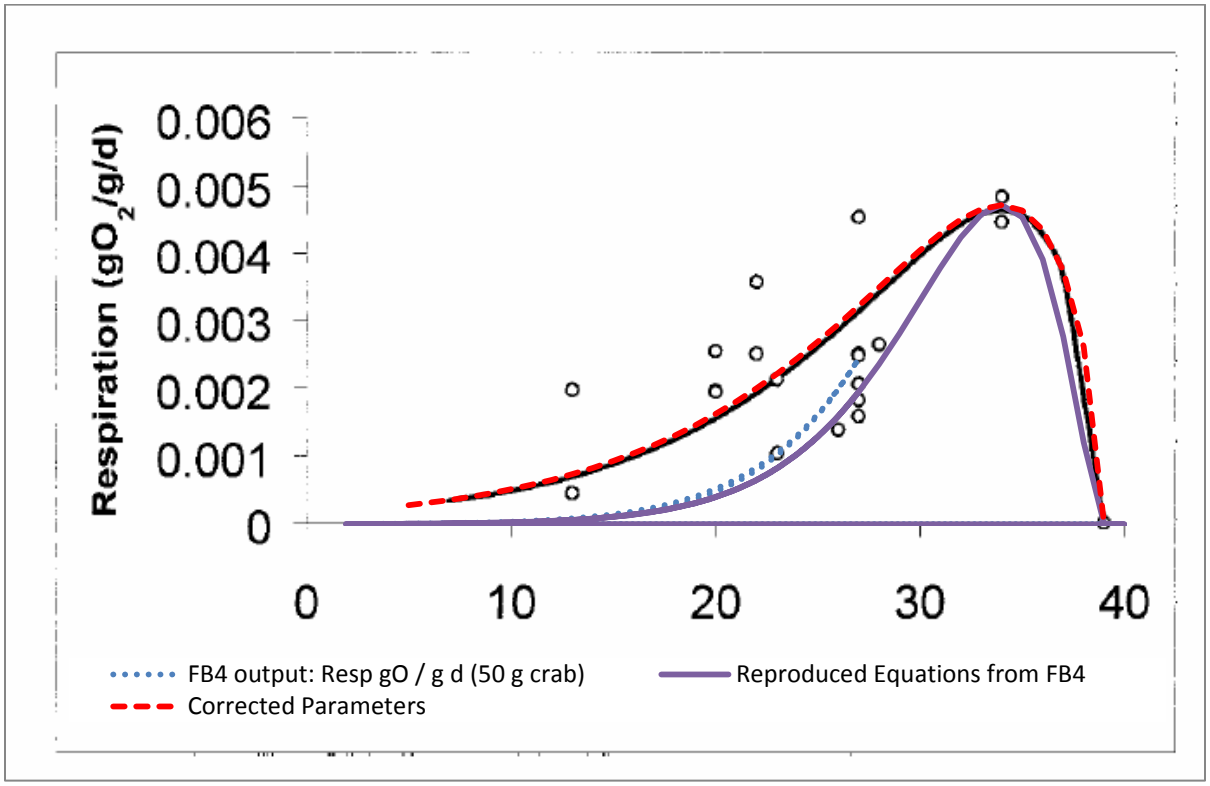

Figure 1. Figure 4 from Brylawski and Miller (black curve) with data (open circles) and derived curves plotted over the top to the same scale. The blue dotted curve is the data from the FB4 model assuming a 50 g crab. The purple curve uses parameters from the paper and reproduced FB4 equations assuming a 180 g crab. FB4 and the derived curve match quite closely, but do not match the black curve. The red dotted line changes the RQ parameter to 3.0 from 5.32 and only then reproduces the literature results quite closely. Note that changing the weight assumption alone does not come close to reproducing the published black-line curve.

The corrected curve produces a significant increase in respiration over the temperature range from 5-25 degrees. This also increases the amount of food required by blue crab (consumption rate shown in Figure 2). An updated consumption to growth model is also required (Figure 3)

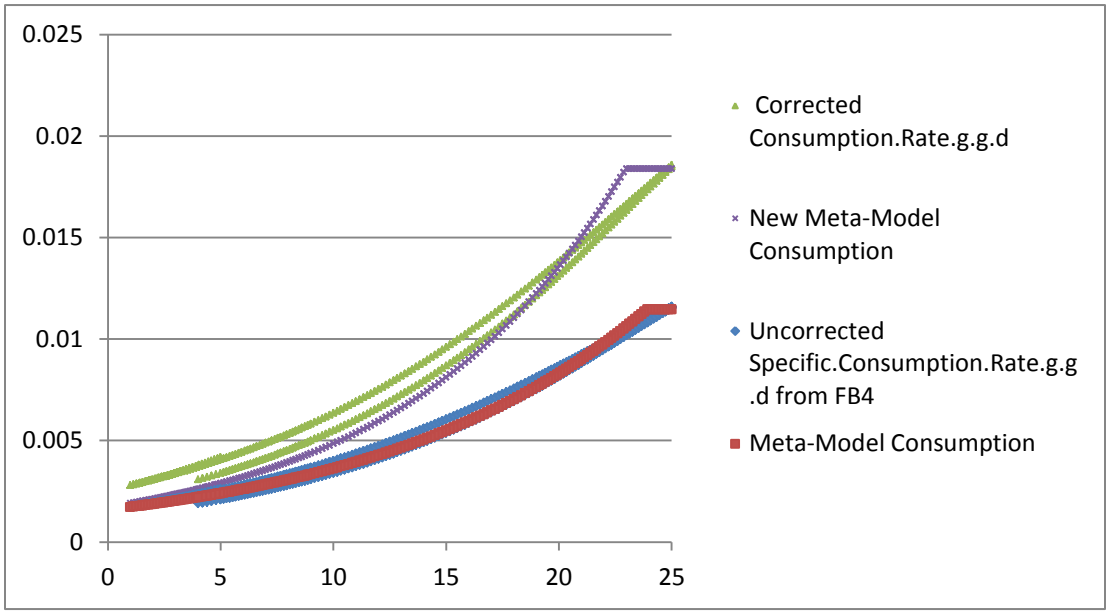

Figure 2. The meta model used within FWM is shown below against the uncorrected FB4 model. A new meta model was derived and is shown above against the corrected FB4 model.

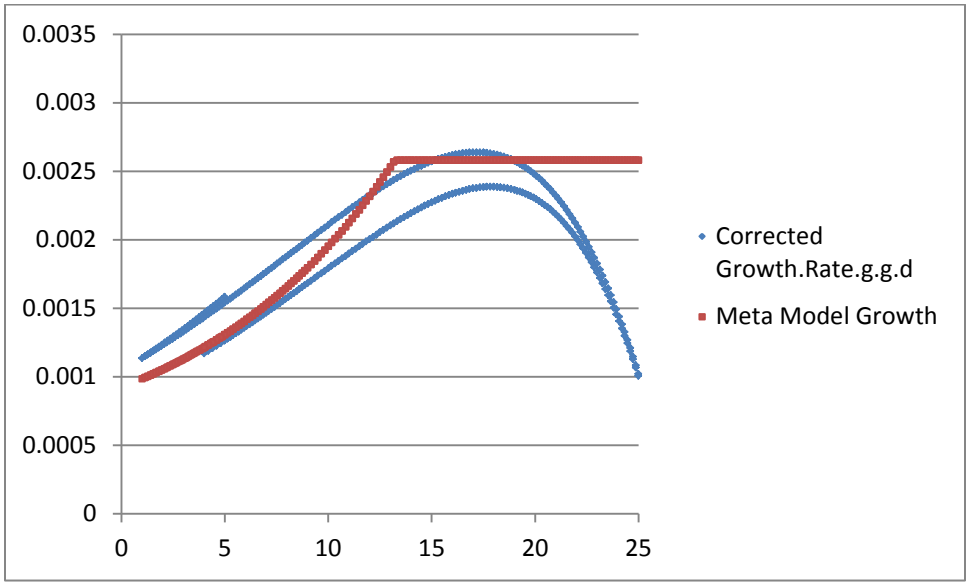

Figure 3. Updated growth rate model using the updated consumption to temperature relationship

The corrected set of parameters for both models looks approximately as follows:

Organism-Specific Parameters	Symbol	Blue crab
Intercept of Temperature vs Specific Consumption Rate relationship (C = exp(a + b * T))	CvTa	-6.357
Slope of Temperature vs Specific Consumption Rate relationship (C = exp(a + b * T))	CvTb	0.1028637
Maximum Specific Consumption Rate	Cmax	0.0184
Intercept of Growth Rate vs Specific Consumption Rate relationship (KG = a + b * C)	KGvCa	0.00035
Slope of Growth Rate vs Specific Consumption Rate relationship (KG = a + b * C)	KGvCb	0.33
Minimum Growth rate (KG) - leave blank for none	KGmin	
Maximum Growth rate (KG) - leave blank for none	KGmax	0.00258

Having tested several model calibrations against this new parameter set – the result is to increase blue-crab concentrations for all contaminants by approximately 50%. An update to model parameters and the model calibration seems warranted given this new information.

Please let us know your thoughts on this matter once you get a chance to attend to it.

Thanks! -- Jonathan

Brylawski, B. J., and Miller, T. J. (2003). "Bioenergetic modeling of the blue crab (Callinectes sapidus) using the fish bioenergetics (3.0) computer program." *Bulletin of marine science*, 72(2), 491–504.